



Status of calorimeters simulation

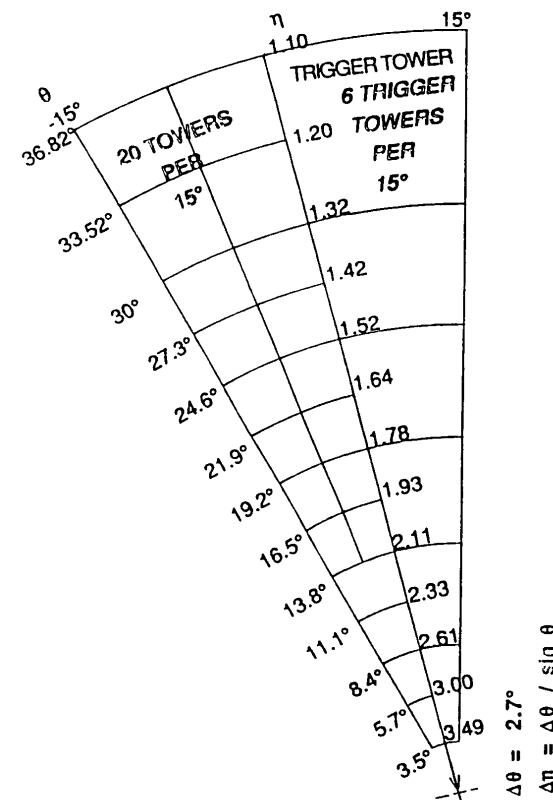
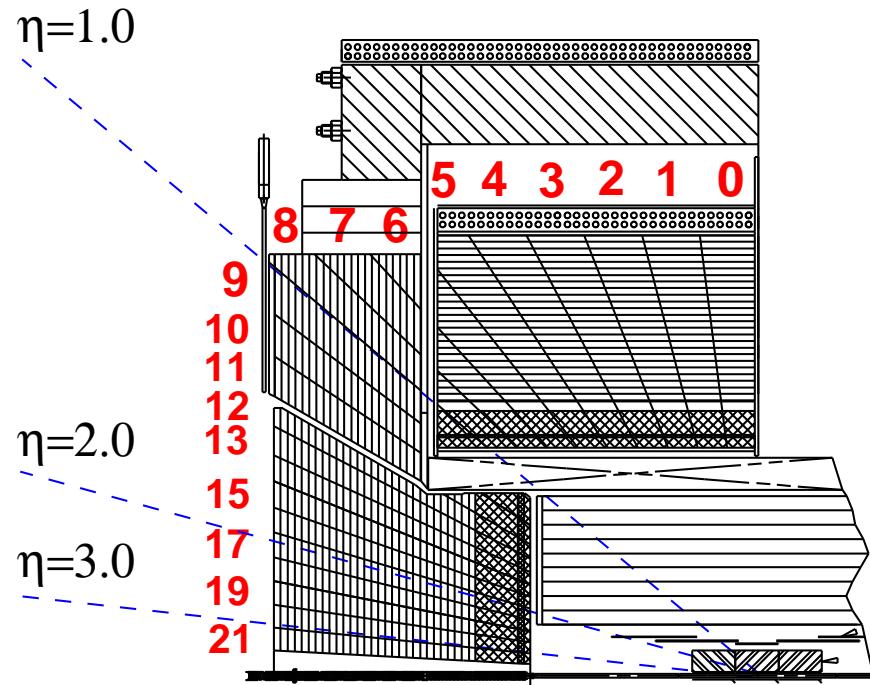
www-cdf.lbl.gov/~currat/talks/

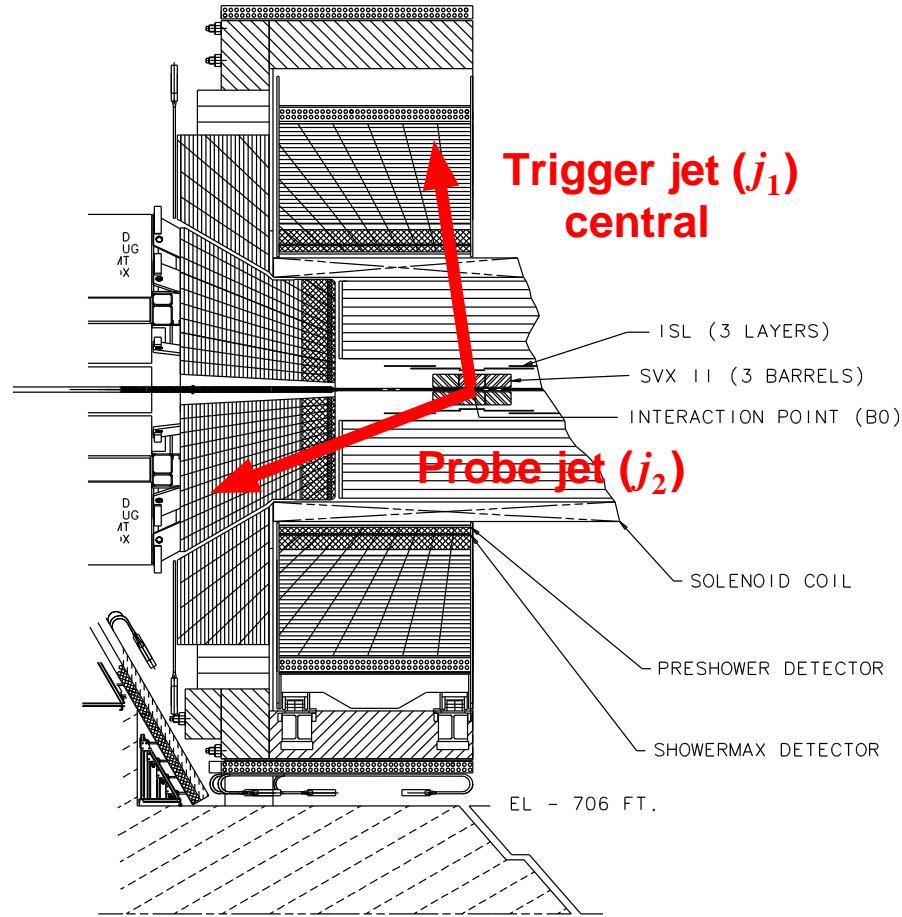
Charles Currat
LBNL

June 24, 2003
Top mass workshop, Lake Geneva WI

- ❖ Comparison v. 4.10.4 data versus v. 4.11.0pre2 MC
- ❖ Known problems
- ❖ Exercises with Gflash (and GEANT)
- ❖ Discussion (+Manfred's)

- ❖ Segmentation of EM and HAD towers is the same
- ❖ Here is quoted the "TDR" naming scheme. This talk uses the "ieta" convention (the one in the code): TDR=21,20,19,... → ieta=4,5,6,...





Probe jet randomly assigned when both jets are central

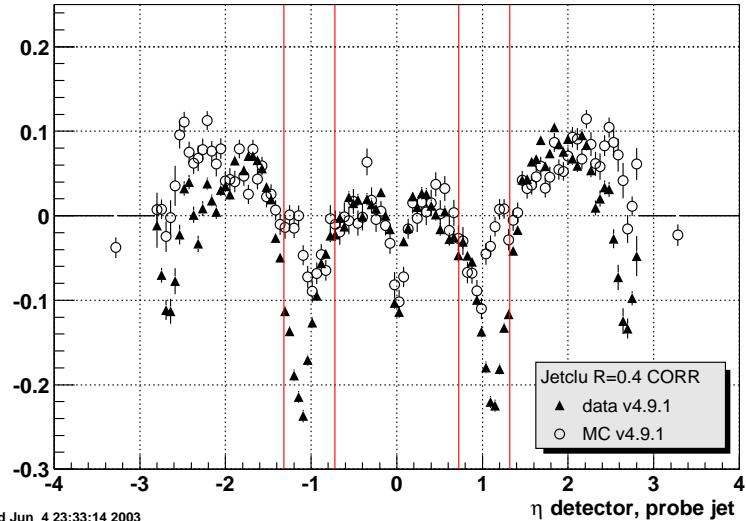
Back-to-back dijet events selection cuts:

- ◆ $|z\text{-vertex}| < 48 \text{ cm}$
- ◆ $E_T \text{ trigger jet } j_1 > 20 \text{ GeV}$
- ◆ $0.2 < |\eta(j_1)| < 0.8$
- ◆ $E_T(j_1) + E_T(j_2) > 40 \text{ GeV}$
- ◆ $\Delta\phi(j_1, j_2) > 2.7$
- ◆ $E_T \text{ 3}^{\text{rd}} \text{ jet} < 15 \text{ GeV}$
- ◆ $\frac{E_T(j_3)}{\frac{1}{2}[E_T(j_1)+E_T(j_2)]} < 0.25$

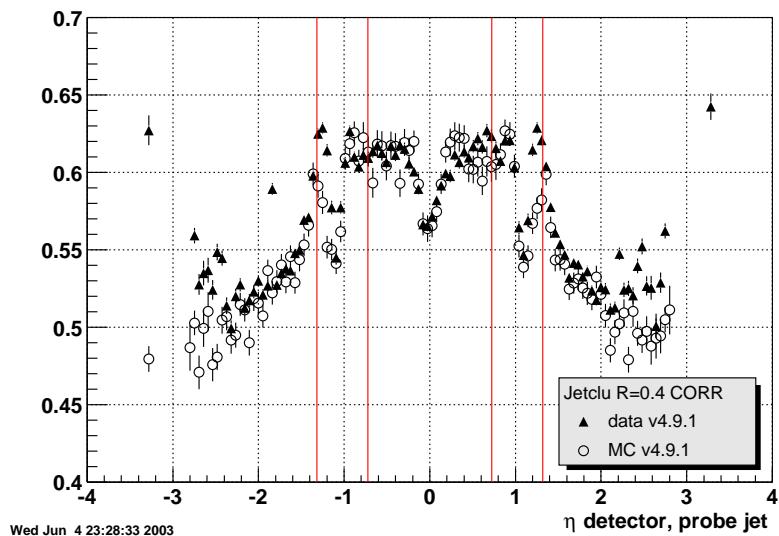
$$B = \frac{p_T^{\text{probe}} - p_T^{\text{trigger}}}{\frac{1}{2}(p_T^{\text{probe}} + p_T^{\text{trigger}})}$$

- ❖ Plug corrected against time dependence (applied at jet level)

JetAna: dijet balance



JetAna: jet EM fraction



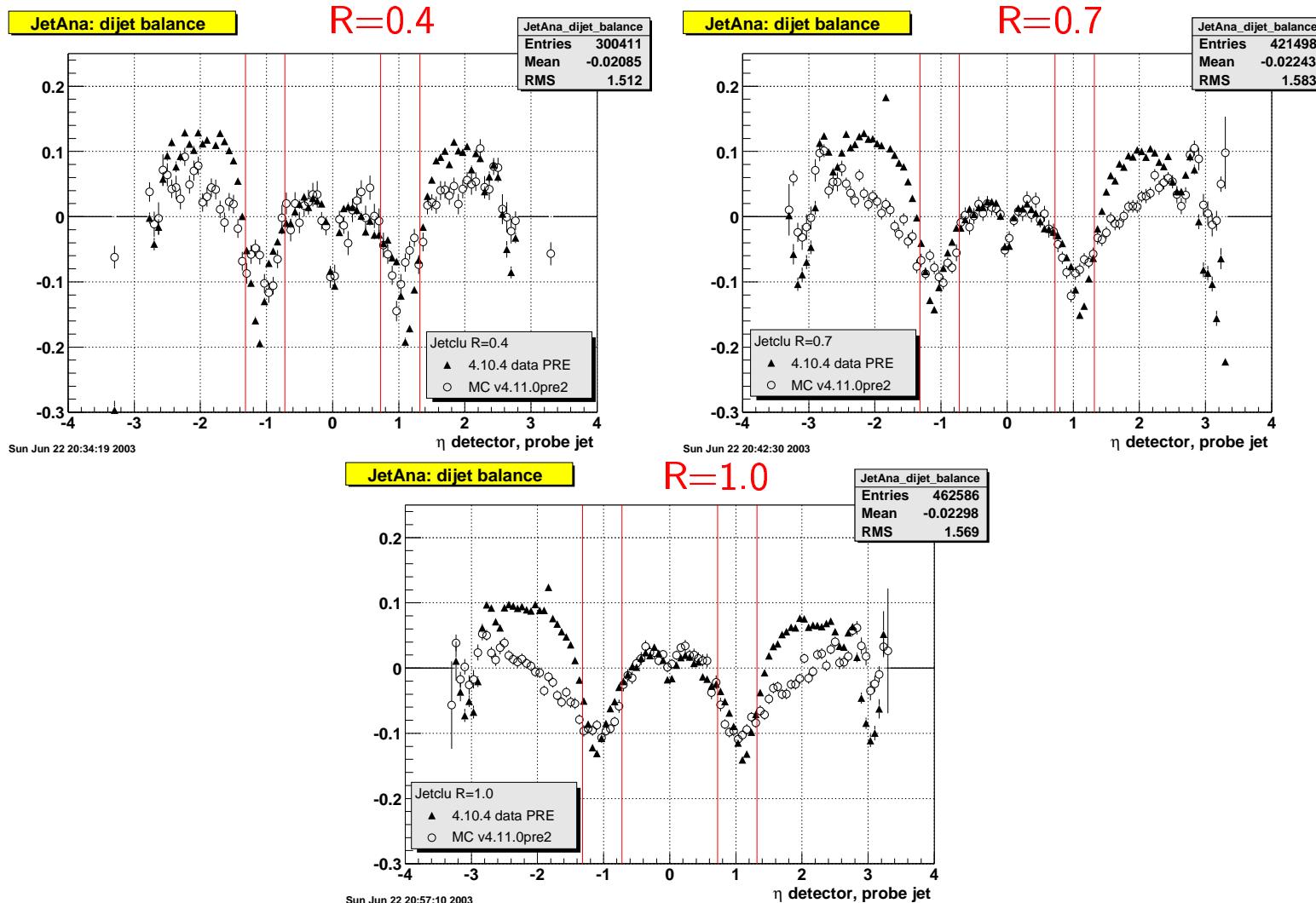
- ❖ Disagreement for jets above $|\eta| > 2.0$ (balance + EM fraction)
- ❖ Abyssal discrepancy in the WHA



Status of simulation: dijet balance



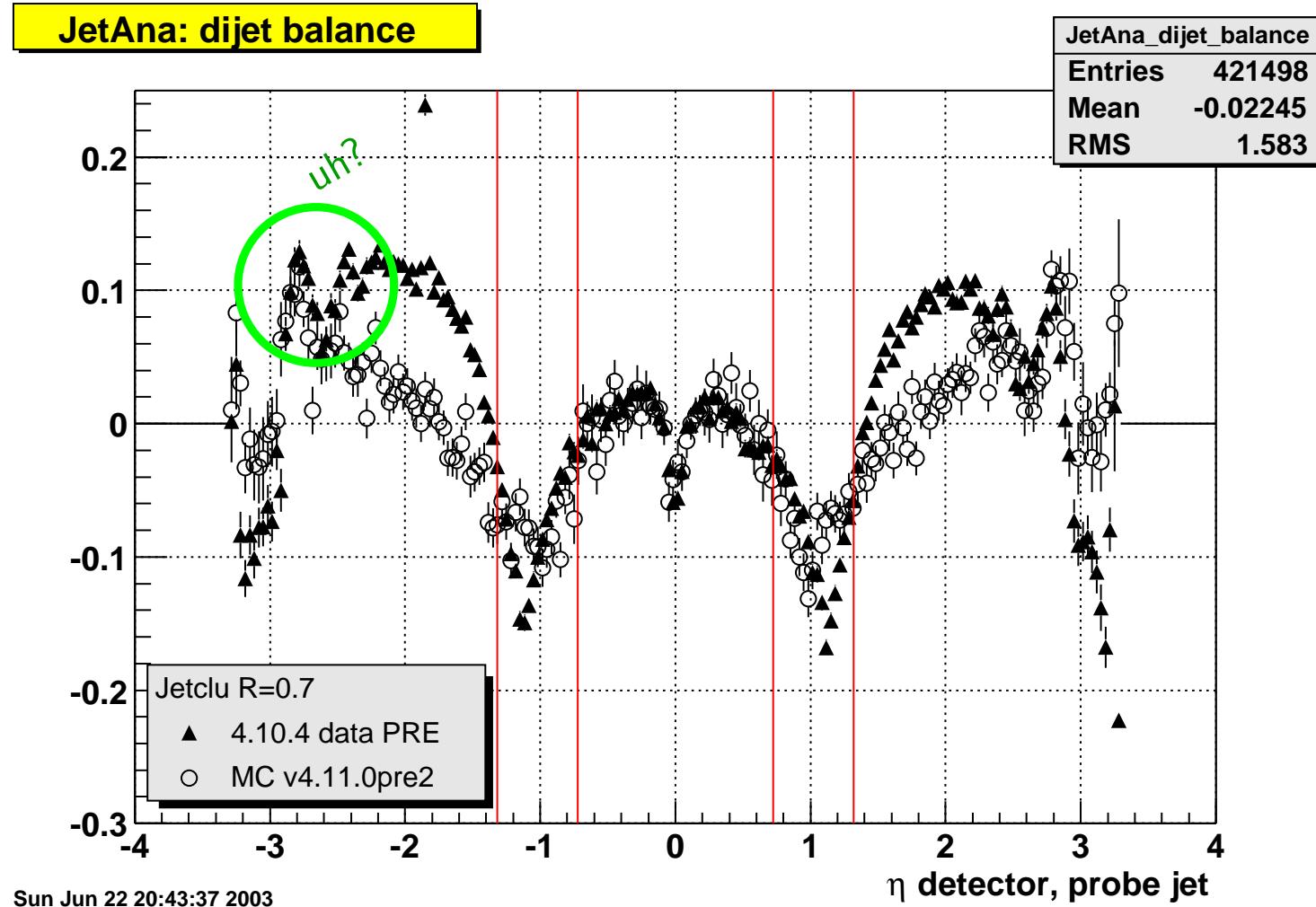
NB: 120 bins plots



👉 "linear rise" related to the underlying event? See further...

Status of simulation: dijet balance

Closeup view with 240 bins



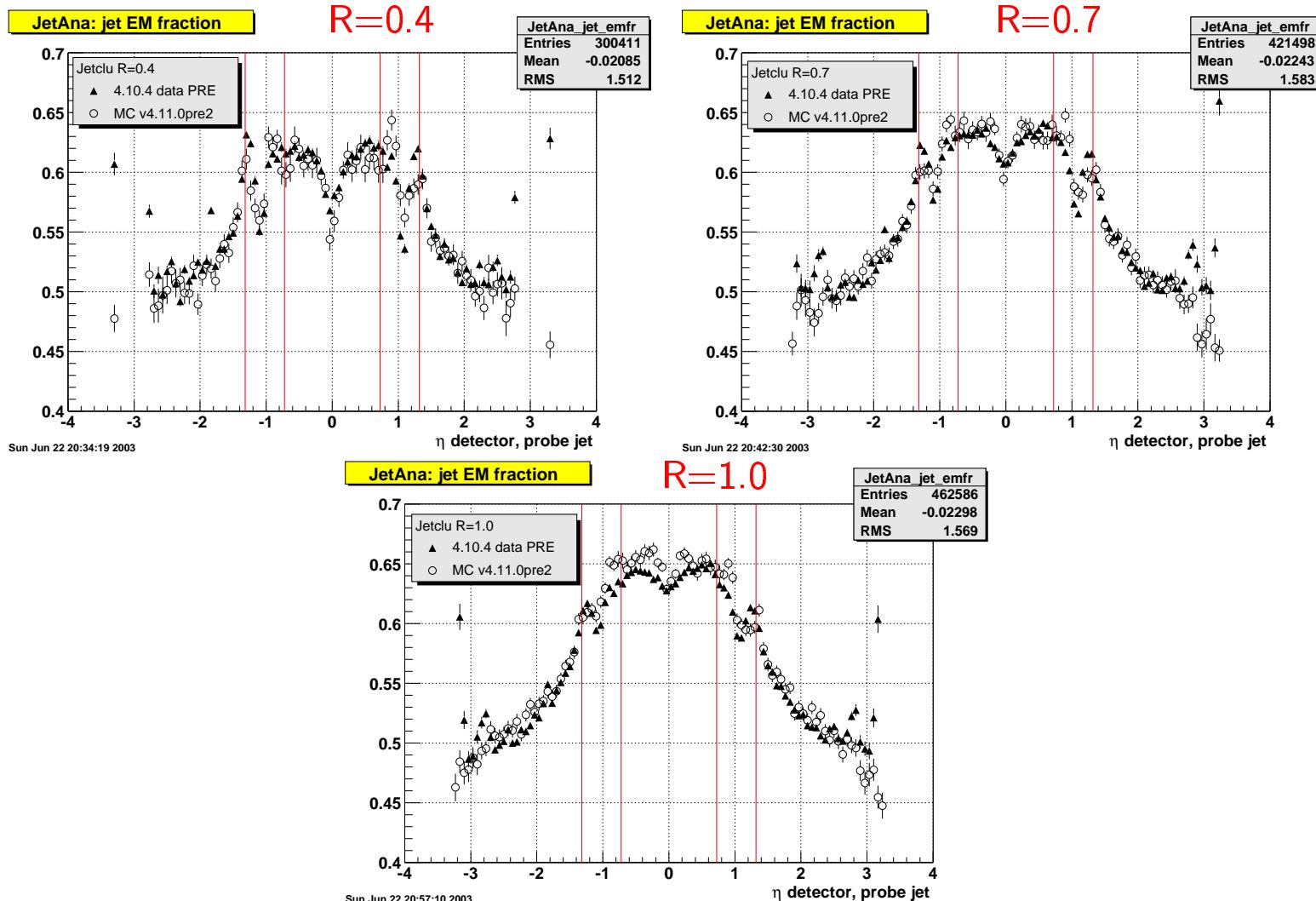
☞ artefact of JetClu due to the fact that towers are getting bigger?



Status of simulation: jet EM fraction



NB: 120 bins plots

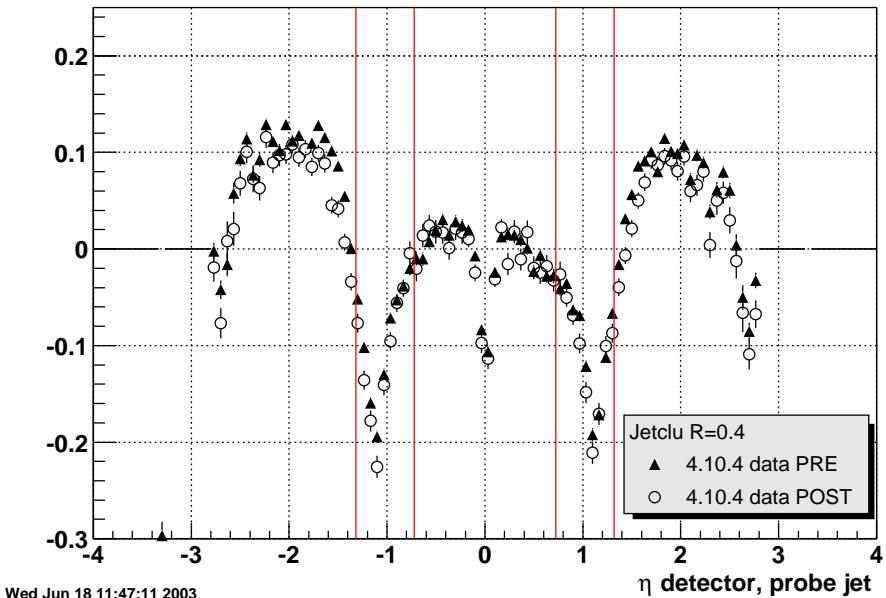




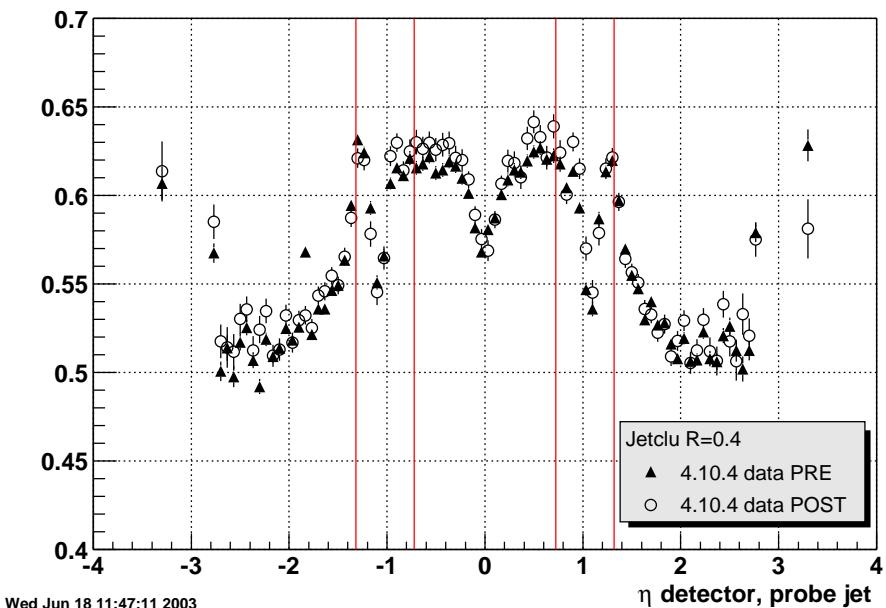
Post- vs pre- shutdown 4.10.4



JetAna: dijet balance



JetAna: jet EM fraction



☞ change of central E scale?? CEM raised ($Z \rightarrow ee$ peak followup looks flat though, cf Larry+Beate)... Giuseppe notices the same effect (way and amplitude) in γ -jet balance



Modifs since 4.9.1



Modifications in the calos simulation between 4.9.1 and 4.11.0pre2

- ❖ geometry fixes in coil geometry + WHA position (CC)
- ❖ passive material at the COT face plate (Elena, Manfred)
- ❖ adjusting T14,15 [11, 10]_{TDR} to pick right parameterization (S. Jun)
- ❖ muons tuning in WHA (S. Jun)... but not implemented yet
- 👉 necessary changes but with no big impact

In passing, sampling structure in WHA \neq CHA by construction (cf CDF BlueBook):
absorber/active \rightarrow 2in/10mm (WHA), 1in/10mm (CHA) \Rightarrow low E_s ?

- 👉 as now all of the shower parameters in Gflash are the same for CHA and WHA...

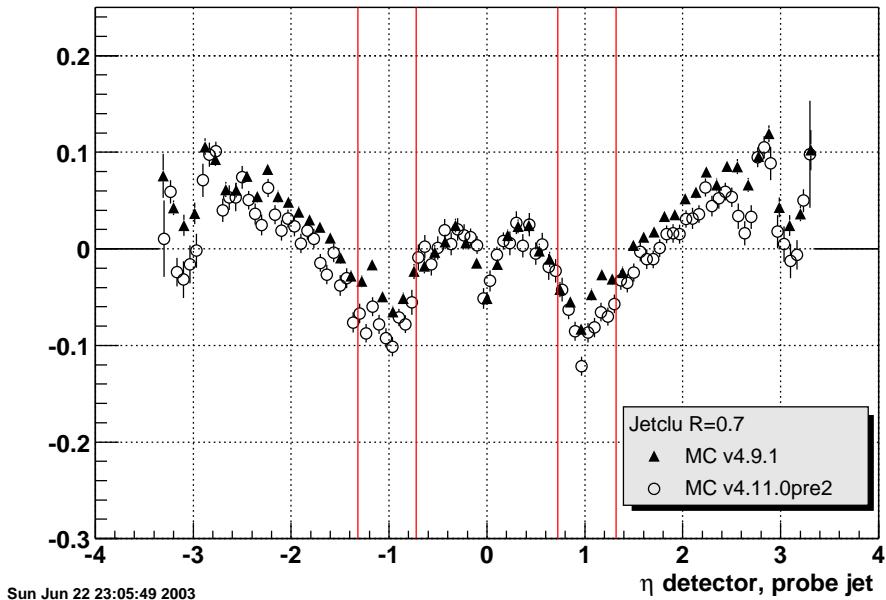


Comparison MC/MC

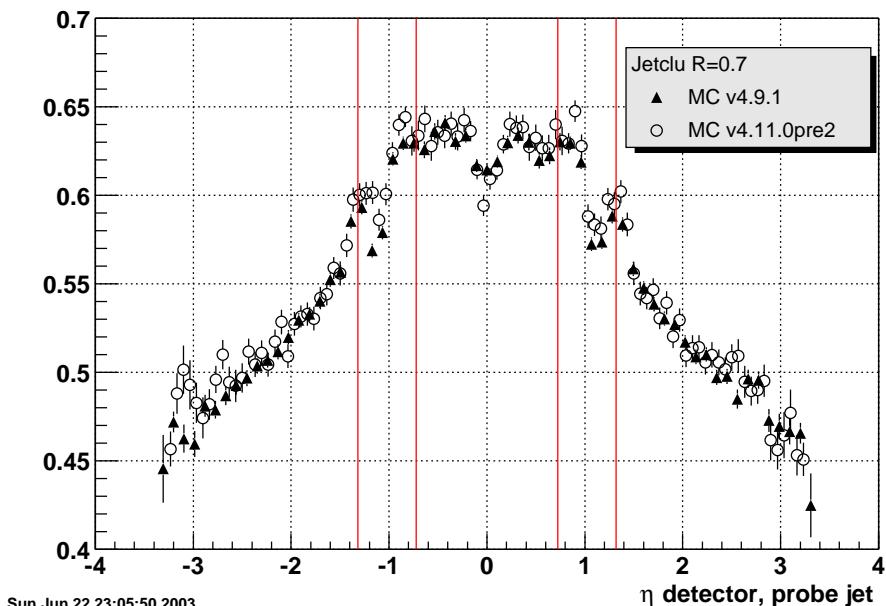


Dijet balance and jet EM fraction between 4.9.1 and 4.11.0pre2

JetAna: dijet balance



JetAna: jet EM fraction





What can be wrong? List of plausible reasons, we checked (are still checking) on...

- ❖ Geometry (dims/position) in GEANT \Rightarrow small modifs needed but no major effect
- ❖ Passive material in GEANT as of v 4.11.0pre2 \Rightarrow not a major effect
- ❖ Cracks in the plugs \Rightarrow no effect... too small (see Jet Correction meeting 5/28/03)
- ❖ Implementation of the various tower "types" (5 different types in $0.9 < |\eta| < 1.4\dots$) \Rightarrow no (at least flagrant) bug
- ❖ Modeling of the underlying event? \Rightarrow I doubt according to what single particle scans look like
- ❖ Non-linearity in the plug \Rightarrow very plausible, working on it... but tune it referring to what? Mimic central (cf CDF#5874)
- ❖ My prejudice too: limitation in Gflash... array dimension, MIN/MAX(constant,f(E)) functions all over the place... (something similar already happened at the time)



Plug tower response to single π 1/2

Shooting 57 GeV π in the center of each plug tower (B field turned off). Energies in [GeV]. **Gflash parameterization**. Gaussian (single) fit on peaks. No AI plate makeshift for COT front plate here (tuned after test beam config).

plug

WHA

ieta	mip [GeV]	EM_mip pk	σ_{EM_mip}	Full_E pk	E/p
plug	4	0.35	54.9	6.6	51.2
	5	0.36	57.8	6.1	54.3
	6	0.36	58.1	6.1	53.5
	7	0.38	57.9	6.3	54.7
	8	0.38	58.2	5.6	54.1
	9	0.37	58.3	6.1	54.1
	10	0.38	58.2	6.3	54.1
	11	0.38	58.4	5.5	54.1
	12	0.39	58.3	6.2	54.3
	13	0.40	58.6	5.8	53.8
WHA	14	0.41	61.1	7.8	56.1
	15	0.28	56.2	6.1	53.6
	16	0.25	57.1	5.8	51.9
	17	0.35	53.7	6.4	44.9
					0.80

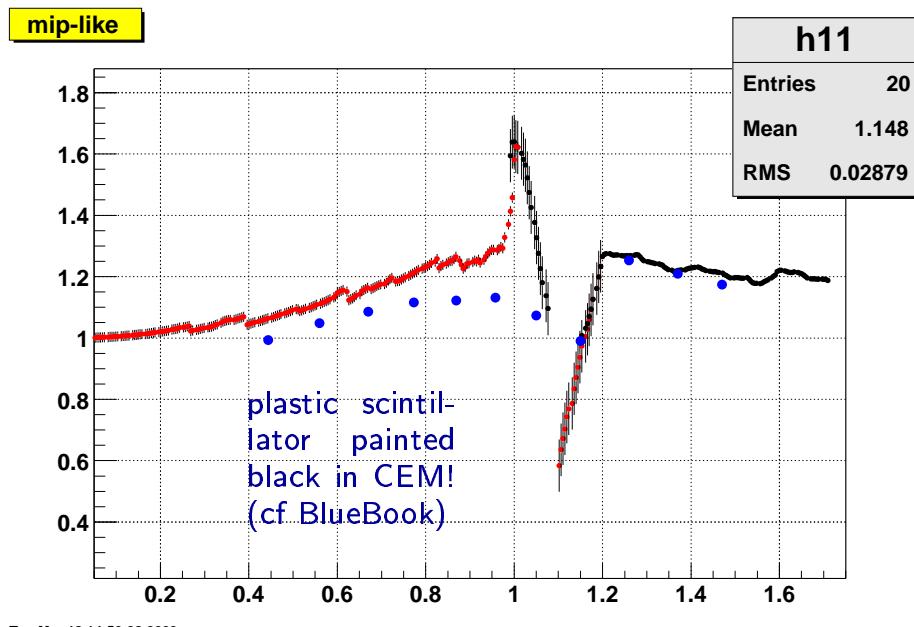
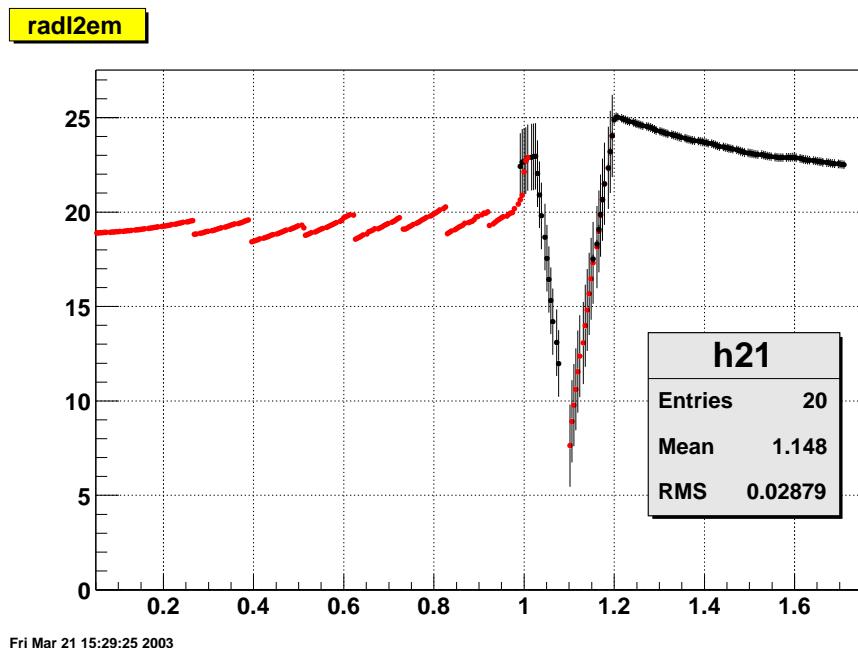
👉 No major problem!



Material scan



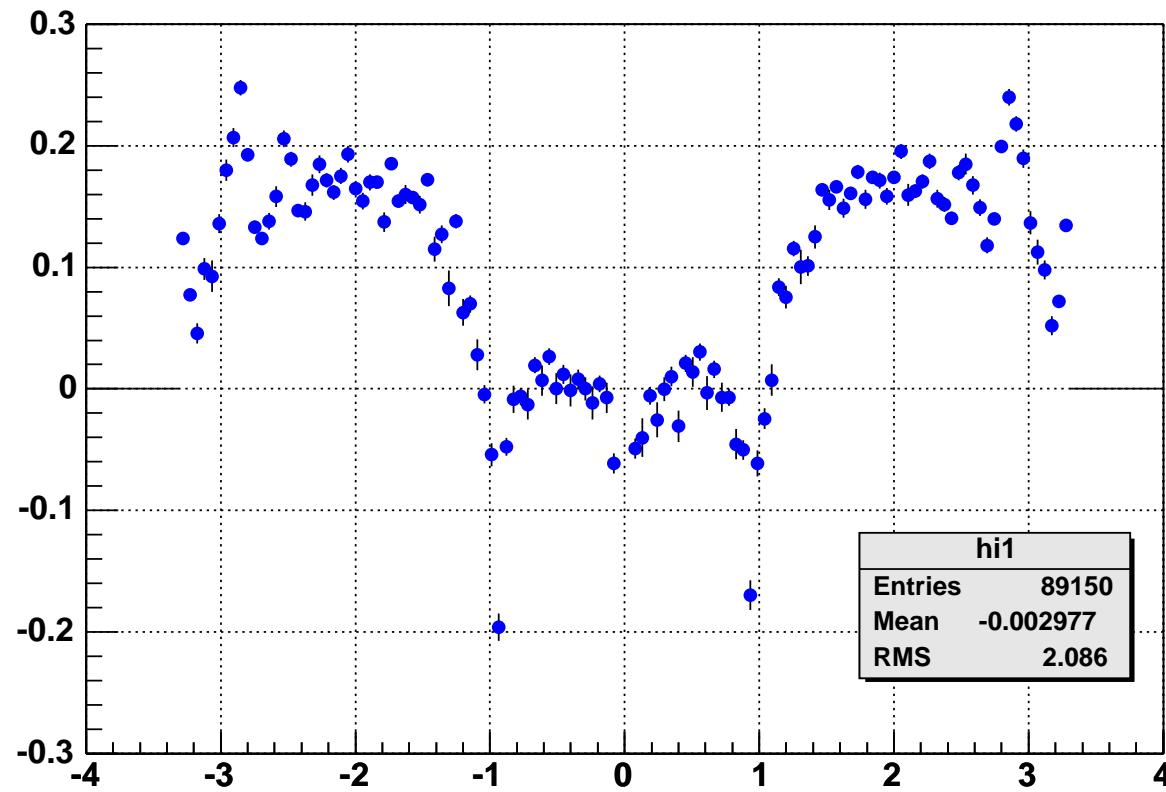
Scan calorimetry with G3XExtrapolator, by parts (red/black), up to front plate of xHA compartment. Compared to Gflash MIP-like particles in xEM compartment (dots)



☞ Amount of material looks to be interpreted correctly by Gflash

Plot of single $p_T = 20$ GeV/c pion balance scan. Assume perfectly balancing (virtual) particle/jet in the central.

Fake_balance [R=0.7]



Mon Jun 23 22:31:18 2003

- 👉 No major problem!
 - ◆ sharp dip in the WHA cracks
 - ◆ nice plateau in the plugs



Non linearity in the plug



Shooting low E π in the center of plug tower W1T8 (ieta=11, B field turned off). Energies in [GeV]. Gflash parameterization. Gaussian (single) fit on peaks.

	E_π	($E_{T\pi}$)	mip [GeV]	EM_mip pk	Full_E pk	E/p
untuned	3	(1.2)	0.35	0.74	0.95	0.32
	5	(2.0)	0.37	3.00	2.7	0.52
	7	(2.8)	0.36	6.52	5.2	0.73
	10	(3.9)	0.37	10.1	8.3	0.83
	20	(7.9)	0.37	20.4	17.9	0.87
	30	(11.8)	0.37	30.6	27.6	0.92
	57	(22.5)	0.38	58.4	54.1	0.95

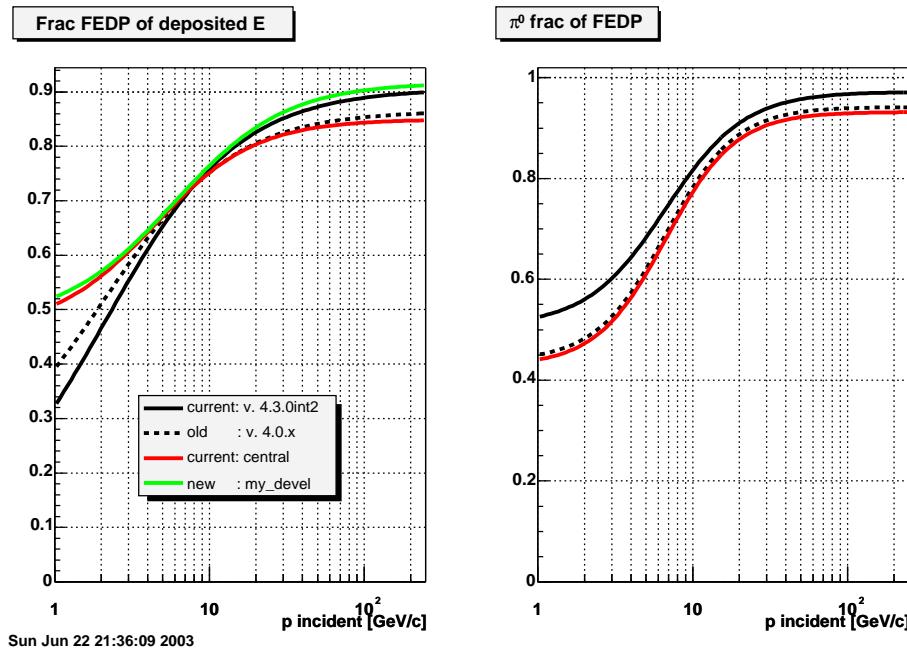
👉 Something to be done (well, was expected...)



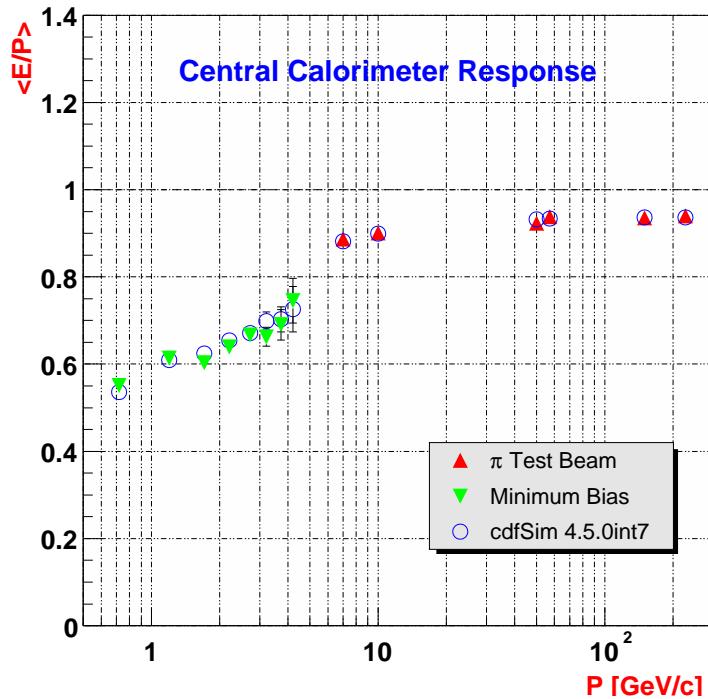
Low E in the plug 1/2



Reminder: Gflash tuning in CDF#5886. Plug tuned down to $E=8$ GeV in W1T8, $E_T = \sin(\theta(\eta = 1.58)) \times E = 3.2$ GeV. Below that, *terra incognita...* and so probably not adequate

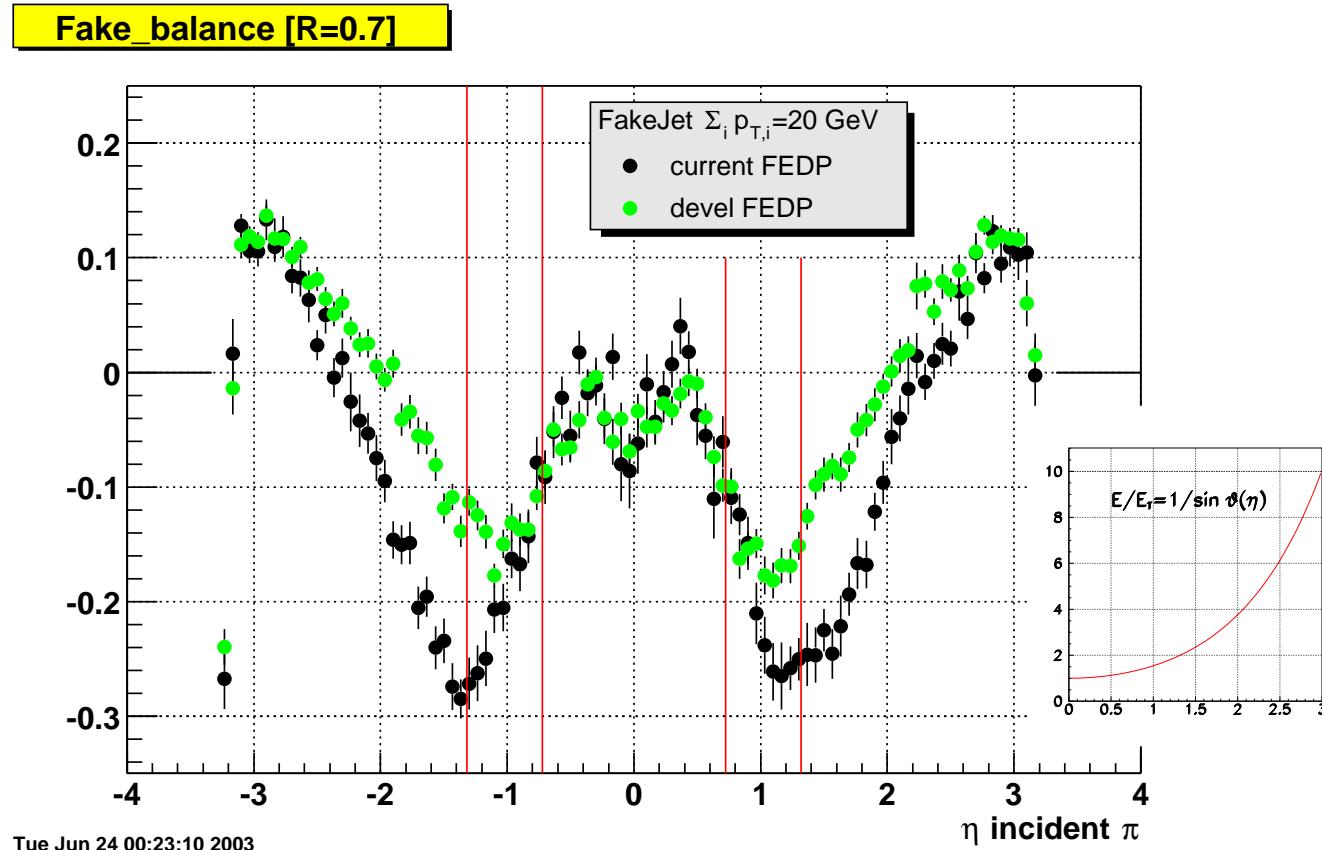


Sun Jun 22 21:36:09 2003



Soon J.,
Sarah D.
(single
tracks)

Check out green curve versus black curve... Home made fake jets based on FakeEvent, 20 particles with $p_T = 1 \text{ GeV}/c$ each with gaussian distribution with $\sigma_R = 0.22$ ($\frac{2}{3}\pi^\pm, \frac{1}{3}\gamma$ abundance)



☞ the problem persists! still no plateau... however points out there's yet another thing to take care of!



Comments/plans



- ❖ Q: can you trust GEANT in the plug...? ↗ Pierre (used to be yes back to the time of CDF#4688...)
- ❖ Sunny is looking at T15,16 [10,9]_{TDR} with electrons
- ❖ Pasha+Beate prepared minimum bias Stntuples for single particle response at low p_T ↗ to be done next
- ❖ Adapt binning to match 1 bin/tower
- ❖ See if the nice "sharp WHA-crack dip and plateau" shape when using single particles is E dependent



More general plan



Slides from Manfred...

- ❖ Re-tuning of low- p_T hadron response
- ❖ Re-tuning of plug hadron response
- ❖ Crack response



Post-talk reactions



Suggestions and Q/A in the audience

- ❖ Henry: go back to DBanks, assess cluster level (suspicious about JetClu)
- ❖ Jaco: last cells in EMF that shoot up... beam remnant splash?
- ❖ Un-Ki: ϕ -profile of EMF in last cells (so, meaning lateral profile I guess)
- ❖ YKK: what about *single* π with $p_T = 1$ GeV?
- ❖ Mel/Henry: use event display to tell between clustering and JetClu
- ❖ Manfred: plot $\Delta(B_{data}, B_{MC})$ at given η (or tower) as f(E) with single particles \Rightarrow would show plateau behavior

Re-tuning of low-pT Hadron Response

Data samples needed:

- Min. bias data: StNtuples of gmbs08 with 4.10.4 calor & 4.8.4 tracking exist
=> still would want official min. bias reprocessed with 4.10.4 (tracking!)
- Single track trigger: Surprisingly exist in Stream G jet_calib (prescaled)
=> StNtuples made by Beate (would want reprocessed with 4.10.4)

Central hadron response:

1. Check E_{MIP} , E_{tot} , E_{em} , E_{had} for 57 GeV testbeam data (sanity check)
2. Check linearity and resolution (σ_E/E vs. E) (sanity check)
3. Select isolated single track candidates from min. bias StNtuples
4. Tune E/p distributions for different p (up to 3-4 GeV)
5. Select isolated single track candidates from single track trigger StNtuples
6. Tune E/p distributions for different p (3-8 GeV)
7. Use both datasets for lateral tuning

Items 1-5 done by Soon, could use 1 person for item 6 & 1 person for item 7

Re-tuning of Plug Hadron Response

Data samples needed:

- Plug testbeam data
- Low pT-tracks in plug (forward tracking)

Plug hadron response:

1. Check E_{MIP} , E_{tot} , E_{em} , E_{had} for 57 GeV testbeam (sanity check)
 2. Check linearity and resolution (σ_E/E vs. E) (sanity check)
 3. After implementation of Cu disk at COT endplate tuning of low-pT response desirable
(what to do about effect of missing final electronics for testbeam data?)
 4. Investigate forward tracking to find isolated low-pT Si-only tracks
- => Items 1 & 2 done by Soon, could use 1-2 persons for items 3 & 4
=> Item 4 could be looked at by a student

Crack Response

Data samples needed:

- Dijet data: StNtuples with 4.10.4 calor & 4.8.4 tracking exist
=> official sample reproduced with 4.10.4 seems to have alignment problem
=> would still want to use official 4.10.4 sample if reprocessing succeeds
- Large Dijet MC sample: 4.11.0pre2 exists
=> would want official 4.11.1 sample of 3 mio. events
- Single tracks into WHA

Crack response:

1. Check again for problems/bugs in Gflash implementation (σ_E/E vs. E)
2. Perform tower scan from CHA -> WHA -> PHA (E_{MIP} , E_{tot} , E_{em} , E_{had})
for different energies
3. Compare single low-pT tracks into WHA with MC
4. Decide on strategy to tune crack response => some thinking needed !

Items 1+2 done by Soon, could use 1 person for item 3

Note: Charles might be leaving => need person for future dijet balancing
and em-fraction analysis

